

**This skills unit contains:**

- more metric measures
- Imperial/metric conversion

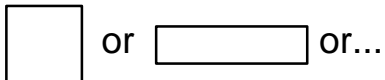
## Measuring Area



**Area** is the measure of **the surface in a shape**; it is measured or worked out in a square unit.

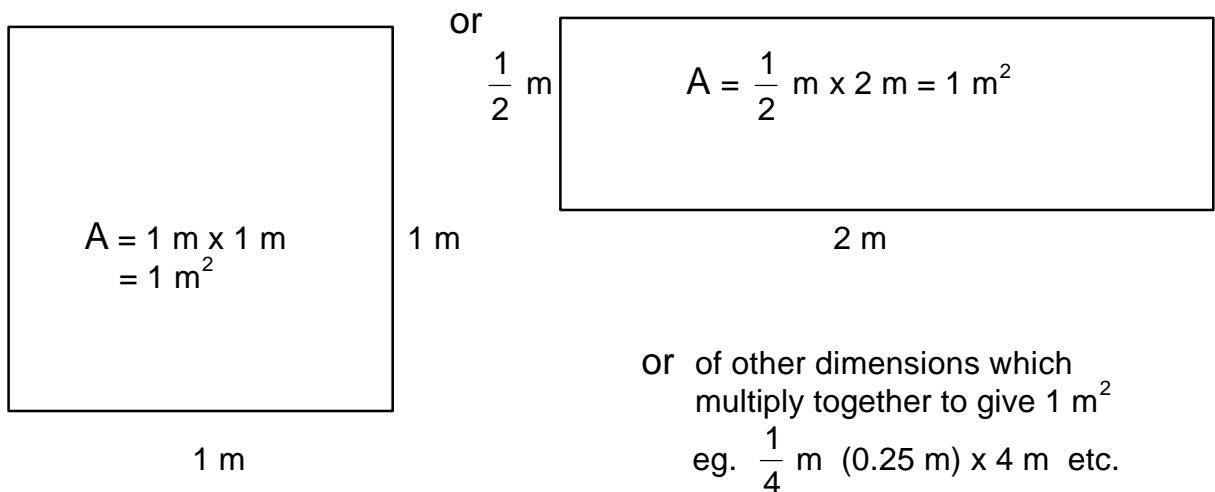
The area of this sheet of paper would be measured in square centimetres.

A square centimetre looks like:



The most common unit of area is the **square metre**.

A square metre could look like:



You use the square metre to measure:

- the floor area of a house
- the number of paving stones for a driveway
- the area of walls to be painted, etc.





### Activity 1

- 1 The term 'footprint' means the area taken up by an object; the computer's footprint is the space it occupies on the desk.

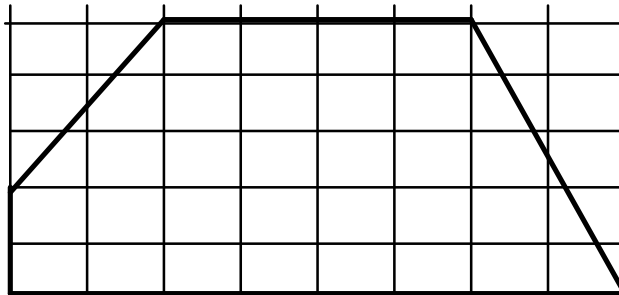
Estimate:

- a) the footprint of an A4 page
- b) a motor car footprint
- c) the footprint of a household refrigerator



- d) the area of a block of land for a house

- 2 Each square of the grid is  $1 \text{ m}^2$ . What is the area of the figure?



### Activity 1 Answers

- 1
  - a) approx.  $600 \text{ cm}^2$  (30 cm x 20 cm)
  - b) approx.  $5 \text{ m}^2$  (2.5 m x 2 m)
  - c) approx.  $0.75 \text{ m}^2$  (1 m x 0.75 m)
  - d) approx.  $900 \text{ m}^2$  (30 m x 30 m)
- 2  $32 \text{ m}^2$

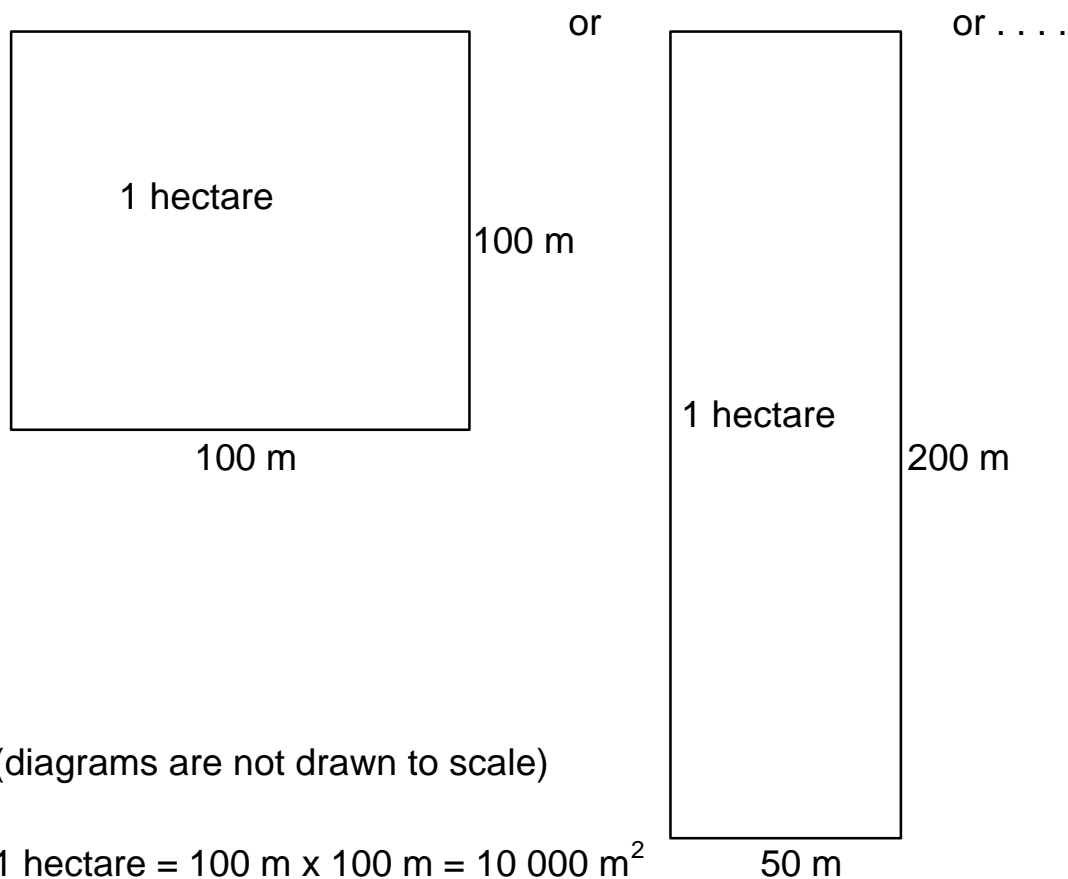
The **hectare** is the **unit used for large areas** eg. the amount of land burnt in a bushfire.

To visualise a hectare, you first need to have a mental picture of 100 m. Two 'pictures' of 100 m which may be useful to you are:

- twice the length of an Olympic swimming pool (50 m long)
- the length of a football ground.

Now try to imagine that same 100 m as the side of a square. The space inside that square will be one hectare ( $10\,000\text{ m}^2$ ) in area.

A hectare could look like:



$$1 \text{ hectare} = 100 \text{ m} \times 100 \text{ m} = 10\,000 \text{ m}^2$$

or

$$1 \text{ hectare} = 50 \text{ m} \times 200 \text{ m} = 10\,000 \text{ m}^2$$

or any combinations of length and width which multiply to give  $10\,000 \text{ m}^2$ .

For **very small areas** like the

- cross-sectional area of a wire or
- cross-sectional area of a piston

the **square millimetre** (□) or **square centimetre** (□) are used.

The unit of area will depend on the metric unit (mm, cm or m) used to measure the dimensions of the shape.

For example, if dimensions are in:

mm, then the area is in  $\text{mm}^2$

cm, then the area is in  $\text{cm}^2$

m, then the area is in  $\text{m}^2$ .

Often you need to change  $\text{mm}^2$  or  $\text{cm}^2$  to  $\text{m}^2$  for use in a formula.

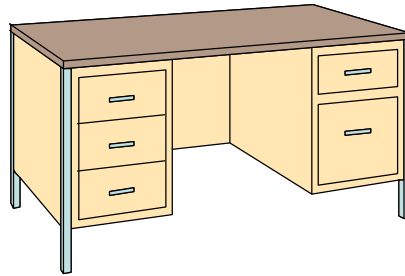
See the **Measurement C** skills unit for ways of doing this.



### Activity 2

1 What unit would you use for the area of:

- a) a golf course?
- b) a desk top?



- c) the size of NSW?
- d) the cross-sectional area of a wire?

2 a) About how many house building blocks will fit on one hectare? [Use the area of the block of land in Activity 1 (d)].

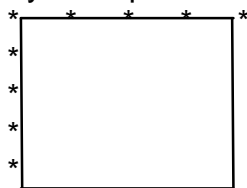
- b) If roses are planted 1 m apart in rows that are also 1 m apart, how many can be planted in one hectare? (a sketch could be useful)

### Activity 2 Answers

- 1 a)  $\text{m}^2$  or hectares
- b)  $\text{m}^2$
- c)  $\text{km}^2$
- d)  $\text{mm}^2$

2 a) about 10 blocks  
( $10\,000\text{m}^2$  (1ha)  $\div$   $900\text{m}^2$ )

- b) try a simpler example to help you:



For a 4 m x 4 m square,  
number of roses =  $5 \times 5 = 25$ .  
For 1 ha ( $100\text{ m} \times 100\text{ m}$ ),  
number of roses =  $101 \times 101$   
= 10 201



**Volume** is the

- **space inside a three-dimensional object** or
- **space occupied by a solid object.**

The most common unit of volume is the **cubic metre ( $\text{m}^3$ )**.

Examples:

- A compost bin one metre long, one metre wide and one metre deep has a volume of  $1 \text{ m} \times 1 \text{ m} \times 1 \text{ m}$ , i.e. a **volume of  $1 \text{ m}^3$**  (one cubic metre), and it has the capacity to hold one cubic metre of compost.
- A volume of one cubic metre also has a **capacity** to contain **1000 litres of liquid**.
- A cubic box, which has a **volume** given by  $10 \text{ cm} \times 10 \text{ cm} \times 10 \text{ cm}$  or  $1000 \text{ cm}^3$ , has a **capacity** of 1 litre.

**( $1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$  so that  $1 \text{ m}^3$  holds 1000 litres.)**

- A swimming pool has a base area of  $9 \text{ m} \times 3 \text{ m}$  and the water is 1 m deep.

What is the water capacity of the pool?

Volume =  $9 \text{ m} \times 3 \text{ m} \times 1 \text{ m} = 27 \text{ m}^3$

Capacity =  $27 \times 1000 \text{ L}$  (each  $1 \text{ m}^3$  can hold 1000 L)  
= 27 000 L

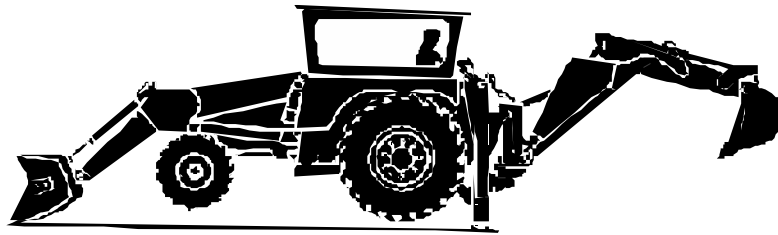


A **volume of  $1000 \text{ cm}^3$**  has a **capacity of 1L** or **1000mL**.

A **volume of  $1 \text{ m}^3$**  has a capacity of **1000L**.

**Activity 3**

1. Estimate in cubic metres ( $\text{m}^3$ ) the volume of :
  - a) a suitcase
  - b) a supermarket shopping trolley.
  - c) a container with dimensions 5 m by 3 m by 2 m high.
2. A ready-mix concrete truck holds  $6 \text{ m}^3$  of concrete. Give three possible rectangular prism shapes that  $6 \text{ m}^3$  of concrete could fill.

**Activity 3 Answers**

- 1
  - a) approx.  $0.2 \text{ m}^3$  (for a suitcase  $1 \text{ m} \times 0.5 \text{ m} \times 0.3 \text{ m}$ )
  - b) approx.  $\frac{1}{3}$  to  $\frac{1}{2} \text{ m}^3$
  - c)  $30 \text{ m}^3$
- 2 possible solutions:
  - $3 \text{ m} \times 2 \text{ m} \times 1 \text{ m}$
  - $4 \text{ m} \times 1 \text{ m} \times 1.5 \text{ m}$
  - $6 \text{ m} \times 1 \text{ m} \times 1 \text{ m}$
  - $1 \text{ m} \times 2 \text{ m} \times 3 \text{ m}$
  - $0.5 \text{ m} \times 12 \text{ m} \times 1 \text{ m}$ , etc.



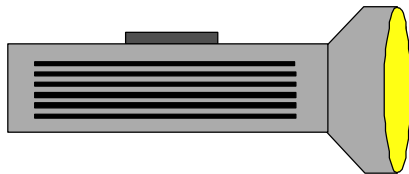
## Some other everyday measurements

Three measurements that refer to **electricity**:

- **the Volt (V) is a measure of voltage**, which is the electrical potential or supply.
- **the Ampere (A) is a measure of current**, which is the flow of electrical charge.
- **the Watt (W) is a measure of electrical power**, which is the rate of using or burning energy.

For each of these units the prefixes '**milli**' and '**kilo**' can be used.

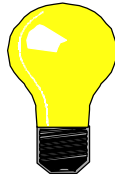
For example, the power used by a household is in kW (kiloWatts) and the current drawn by a torch bulb is in mA (milliAmperes).



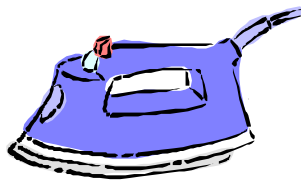
**Activity 4**

- 1 Match items in the list on the left to their likely electrical unit rating.

'C' Dry cell	12 V
Torch bulb	240 V
Car battery	2 V, 0.5 W, $\frac{1}{4}$ A
Car headlight	1.5 V
Powerpoint	1000 W, 240 V, 4 A
Radiator	60 W, 240 V, $\frac{1}{4}$ A
House light bulb	100 W, 12 V, 8 A



- 2 Look up the operating voltage, current and power of 3 common items such as a VCR, cassette recorder, radio, refrigerator, washing machine, toaster, electric iron, etc.



**Activity 4 Answers**

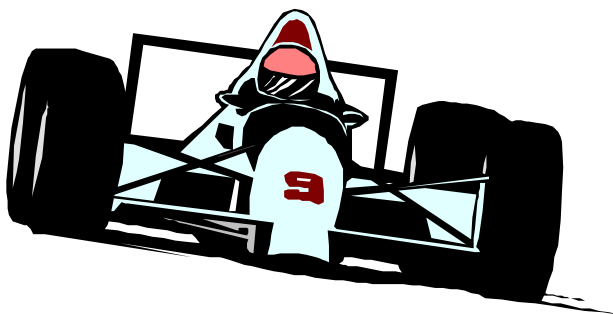
- |   |                                 |                              |
|---|---------------------------------|------------------------------|
| 1 | 'C' dry cell                    | 1.5 V                        |
|   | torch bulb                      | 2 V, 0.5 W, $\frac{1}{4}$ A  |
|   | car battery                     | 12 V                         |
|   | headlight                       | 100 W, 12 V, 8 A             |
|   | powerpoint                      | 240 V                        |
|   | radiator                        | 1000 W, 240 V, 4 A           |
|   | light bulb                      | 60 W, 240 V, $\frac{1}{4}$ A |
| 2 | depends on the items you choose |                              |

**More common metric units - density and speed**

The **density** of a material (eg. water, iron or soil) is its **mass per unit of volume**. Foam beads have a very low density but sinkers, used in fishing, are made from high density lead.

The most common units of density are:

- kilograms per cubic metre ( $\text{kg/m}^3$ )
- and
- grams per cubic centimetre ( $\text{gm/cm}^3$ )



**Speed** is important  
in today's world!

**Speed** and its units of measurement are constantly talked about.

Racing cars travel at speeds of more than 250 km/hr. This means that a distance of 250 km is travelled in 1 hour.

The most common units of speed are:

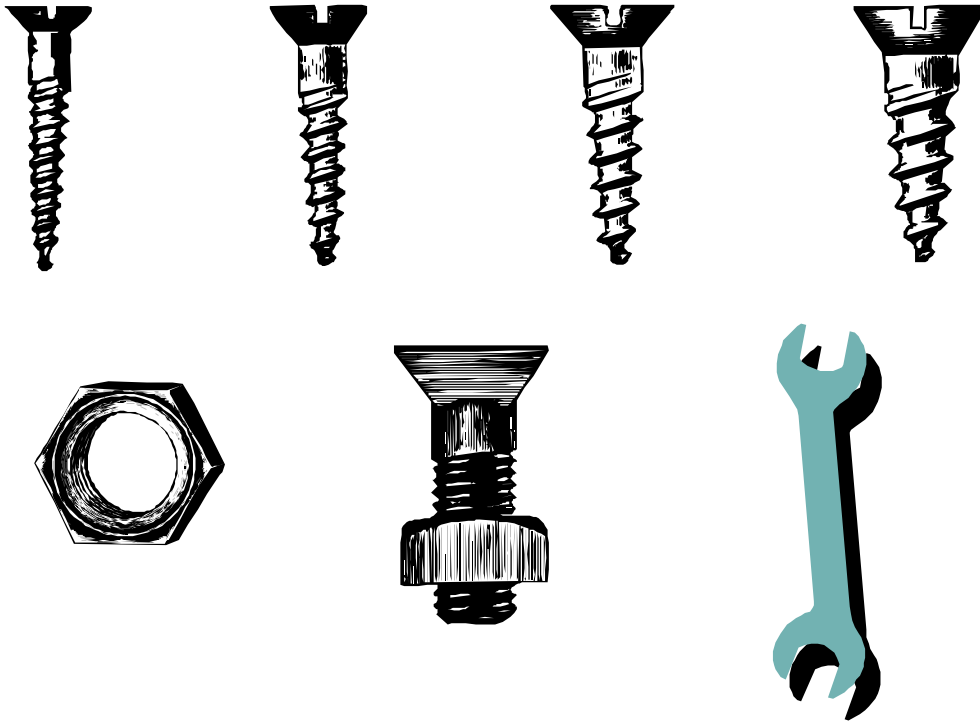
- kilometres per hour (km/hr)

and

- metres per second (m/sec)

## Imperial ↔ Metric Conversions

Although the metric system of units of measurement has been adopted by most countries, a few still use the imperial system of units.



This means that when using tools and equipment made in other countries, you may need to convert a measurement from imperial to metric (or vice versa) to make sure that you are using the right tool for a job. You can use a conversion table and a calculator to do this.

	<b>Imperial measurement</b>	<b>Metric equivalent</b>
<b>Length:</b>	1 inch (1")	25.4 mm or 2.54 cm
	1 foot (1' or 12")	305 mm or 30.5 cm
	1 yard (36")	914.4 mm or 0.914 m
	1 mile	1.6 km
	or 0.625 ( $\frac{5}{8}$ ) mile	1 km
<b>Mass:</b>	1 ounce (1oz)	30g
	1 pound (1lb)	0.4536 kg
	or 2.2 lb	1 kg
	1 ton (2240 lb)	1016 kg
<b>Capacity:</b>	1 pint	600 mL
	1 gallon	4.546 L

Example:

A speed of 12 m/ sec is the same as:

	0.012 km/sec	
or	0.012 x 60 km/min	(60 sec = 1 min)
or	0.012 x 60 x 60 km/hr	(60 min = 1 hr)
ie.	43.2 km/hr	

Follow this conversion example carefully:

A pollutant is measured as 0.6 oz/gallon.  
What is this in g/L?

0.6 oz/gallon = 0.6 x 30 g/gallon	(30 g = 1 oz.)
= 18 g/gallon	
= 18g / 4.546 L	(1 gallon = 4.546 L)
= 4 g/L	(18 ÷ 4.546)

**Activity 5**

- 1 Use the conversion table on the previous page to change:
  - a) 10 pints to \_\_\_\_\_ mL and \_\_\_\_\_ L
  - b) 850 miles to \_\_\_\_\_ km
  - c)  $5\frac{1}{2}$  inches to \_\_\_\_\_ mm
  - d) 200 km to \_\_\_\_\_ miles
  - e) 5 pound to \_\_\_\_\_ kg
  - f) 8 ounces to \_\_\_\_\_ g
- 2
  - a) A building stud is 8 feet (96") on a plan. Change this to metres.
  - b) A 4 gallon drum has a capacity of \_\_\_\_\_ litres.
  - c) A fuel consumption of 30 miles/gallon is equivalent to \_\_\_\_\_ L/100km.  
(Hint: first change miles → km and gallons → litres to get km/L and L/km. Then change to L/100km).

**Activity 5 Answers**

- |   |    |                |   |    |                      |
|---|----|----------------|---|----|----------------------|
| 1 | a) | 6000 mL or 6 L | 2 | a) | 2438.4 mm or 2.438 m |
|   | b) | 1360 km        |   | b) | 18.184 L             |
|   | c) | 139.7 mm       |   | c) | 9.471 L/100 km       |
|   | d) | 125 miles      |   |    |                      |
|   | e) | 2.268 kg       |   |    |                      |
|   | f) | 240 g          |   |    |                      |

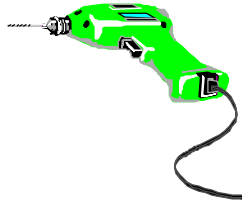
Below is a table of some imperial bolt sizes and their metric equivalents:

Imperial size	Metric equivalent
$\frac{1}{8}$ "	3.175 mm
$\frac{1}{4}$ "	6.35 mm
$\frac{5}{16}$ "	7.938 mm
$\frac{3}{8}$ "	9.525 mm
$\frac{1}{2}$ "	12.7 mm



**Activity 6**

Circle the metric drill size you would select for each imperial size:

**Imperial****Metric**

- |                     |                       |
|---------------------|-----------------------|
| a) $\frac{1}{2}$ "  | 12 mm; 13 mm; 12.5 mm |
| b) $\frac{1}{4}$ "  | 6 mm; 7 mm; 6.5 mm    |
| c) $\frac{1}{8}$ "  | 3 mm; 3.5 mm; 4 mm    |
| d) $\frac{5}{16}$ " | 7 mm; 7.5 mm; 8 mm    |

**Activity 6 Answers**

- |    |         |
|----|---------|
| a) | 12.5 mm |
| b) | 6.5 mm  |
| c) | 3 mm    |
| d) | 8 mm    |

***Test yourself on this skills unit***

- 1 A ranger's quick estimate of the area of burnt forest is 920 000 m<sup>2</sup>. What is this area in hectares?
- 2 Change:
  - a) a speed of 15.6 m/s to km/h
  - b) an area of 1.54 mm<sup>2</sup> to m<sup>2</sup>
- 3 A solution has a concentration of 3.5 g/L.  
How many
  - a) mg/L?
  - b) g/100 L?
- 4 The length and diameter of a steel cable are given as 3.5 yards and 18 inches. Change both of these measurements to metres.

***Test yourself on this skills unit Answers:***

- 1 92 ha
- 2
  - a) 56.16 km/hr
  - b)  $1.54 \times 10^{-6}$  m<sup>2</sup> or 0.000 001 54 m<sup>2</sup>
- 3
  - a) 3500 mg/L
  - b) 350 g/100 L
- 4 length: 3.199 m  
diameter : 0.457 m